Health Consultation

Analysis of Cancer Incidence near the

(Former) Long Branch Manufactured Gas Plant

Long Branch, Monmouth County, New Jersey

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New Jersey Department of Health and Senior Services
Division of Epidemiology, Environmental and Occupational Health
Consumer and Environmental Health Services

in cooperation with

Agency for Toxic Substances and Disease Registry
U.S. Department of Health and Human Services

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Purpose

At the request of concerned citizens living near the former Long Branch Manufactured Gas Plant (MGP) in Long Branch, cancer incidence was separately evaluated for the entire city of Long Branch and the census tract where the facility was located. Total cancer incidence and 13 specific cancer types were evaluated in this investigation. The specific cancers types were selected because they represent cancer groupings that may be more sensitive to the effects of environmental exposure, though not necessarily related to the specific contaminants found at the Long Branch MGP.

Background and Statement of Issues

The former Long Branch MGP is located within the city of Long Branch, approximately one-quarter mile west of the Atlantic Ocean, and consists of approximately 12 acres in a residential/commercial section of the city. The MGP facility operated from approximately 1870 through 1960 and involved the manufacture of water gas, carbureted water gas, and oil gases. Numerous structures, including retorts, gas holders, tar separators, storage tanks and repair shops were present on the property to support the coal-gas processes (NUS Corp, 1990). A portion of the former MGP property was redeveloped in the 1950's by the Long Branch Housing Authority into an apartment complex.

Characterization of the site, including areas that are currently residential, identified numerous chemical contaminants in the environment (ARCADIS, 2002). Evaluation of on-site soil samples detected a variety of chemical contaminants with concentrations above the New Jersey Department of Environmental Protection's residential soil cleanup criteria including benzene, acenaphthylene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, indeno(1,2,3-cd)pyrene, phenanthrene, antimony, arsenic, cadmium, copper, lead, and zinc. Many of these contaminants are part of a broad class of chemicals called polycyclic aromatic hydrocarbons (PAHs). Potential past and possibly current human pathways of exposure

include dermal contact with contaminated soil, inhalation of vapors emanating from the contaminated soil, and ingestion of contaminated soil.

Benzene is considered to be a human carcinogen and has been associated with the development of a particular type of leukemia called acute myeloid leukemia (ATSDR, 1997). Exposure to PAHs have been documented to cause tumors in laboratory animals (ATSDR, 1995). PAHs are considered a probable human carcinogen based on animal experiments (American Cancer Society, 2003a). Epidemiologic studies show that people exposed to PAHs by breathing or skin contact for long periods to mixtures of PAHs may also have increased risk of developing cancer, especially lung and skin cancers (ATSDR, 1995).

Methods

Study Area and Population

The Long Branch MGP study area for the evaluation of cancer incidence consisted of the entire population residing in the town. In addition, the census tract where the facility was located (census tract 8056) was evaluated separately. The U.S. Census Bureau designates the boundaries for census tracts by the size of the population rather than the area of land encompassed by the census tract.

Cancer Case Ascertainment and Study Period

The New Jersey State Cancer Registry was used for the ascertainment of cancer cases. The Cancer Registry is a population-based cancer incidence registry covering the entire state of New Jersey. By law, all cases of newly diagnosed cancers are reportable to the Registry. In addition, the Registry has reporting agreements with the states of New York, Pennsylvania, Delaware and Florida. Information on New Jersey residents who are diagnosed in those states is supplied to the New Jersey State Cancer Registry. The Registry has been in operation since October 1, 1978.

The study period for this investigation was January 1, 1979, through December 31, 2000. A "case" was defined as an individual who was diagnosed with a new primary

malignant cancer during the study period while residing in Long Branch. Registry cases identified only through search of death records were excluded from this evaluation. Information on risk factors, such as personal lifestyle habits, are not available from the Cancer Registry.

Data Analysis

Analyses were completed for all malignant cancer types combined and for select cancer types for the entire city of Long Branch and, separately, for the census tract where the facility was located. The select cancer types analyzed include: bladder, brain and central nervous system (CNS), female breast, colorectal, esophageal, pancreas, lung and pleura, leukemia, non-Hodgkin's lymphoma, liver, bone, stomach, and kidney. These cancer types were evaluated because they represent cancer groupings that may be more sensitive to the effects of environmental exposures. Males and females were evaluated separately. Analyses were conducted for all races combined, Whites, and Blacks.

Standardized incidence ratios (SIR) were used for the quantitative analysis of cancer incidence in the study areas (Kelsey, Thompson and Evans, 1986; Breslow and Day, 1987). The SIR is calculated by dividing the observed number of cases (from the Registry) by an expected number for the surveyed population over the time period reviewed.

The expected number was derived by multiplying a comparison population's age-sex-specific incidence rates and the study area age-sex-specific population figures. The comparison rates used to derive the expected number of cases were the New Jersey average annual incidence rates for 1979 to1999. The study area age-sex-specific population was determined from the 1980, 1990, and 2000 U.S. Census data (U.S. Census Bureau, 1980, 1990, 2000). Eighteen age-specific population groups were used in the analysis.

Evaluation of the observed and expected numbers is accomplished by interpreting the ratio of these numbers. If the observed number of cases equals the expected number of cases, the SIR will equal one (1.0). When the SIR is less than one, we conclude that

fewer cases were observed than expected. Should the SIR be greater than one, more cases than expected were observed.

Random fluctuations may account for some SIR deviations from 1.0. Statistical significance of deviations from SIR equal to 1.0 was evaluated using a 95% confidence interval[7] (C.I.). The 95% C.I. was used to evaluate the probability that the SIR may be greater or less than 1.0 due to chance alone, and was based on the Poisson distribution (Breslow and Day, 1987; Checkoway, Pearce, and Crawford-Brown, 1989). If the confidence interval includes 1.0, then the estimated SIR is not considered to be statistically significantly different than 1.0.

Results

Table 1 presents the Long Branch population by age, race, and sex for the years 1980, 1990, and 2000. The citywide population, all races combined, dropped slightly from 1980 (29,819) to 1990 (28,658) and then rose in 2000 (31,340). The White and Black populations followed a similar pattern with Whites comprising from 68% to 74% of the total Long Branch population. The proportion of males increased slightly through the time period from 46% to 49% of the total population.

Census tract (CT) 8056 is one of nine census tracts in Long Branch (based on the 1990 census tracts, see Figure 1). The population in CT 8056, all races combined, dropped slightly throughout the study period from 2,747 in 1980 to 2,621 in 1990 and 2,298 in 2000 (Table 1). CT 8056, one of the least populated census tracts in Long Branch, had a decreasing percentage of the total citywide population through the study period, representing 9.2% in 1980 and falling to 7.3% in 2000. The percentage of Blacks in CT 8056 was substantially higher than the city as a whole, varying from 55% to 66% of the census tract between 1980 and 2000. From 22% to 30% of the citywide Black population resided in CT 8056 over the study period. The proportion of males in CT 8056 increased slightly through the time period from 42% to 47% of the total population.

Table 2 presents the number of malignant incident cases by race, sex, and age group for Long Branch and CT 8056. For the town as a whole, a total of 3,261 cases were

diagnosed in city residents during the years 1979-2000. Of those cases, 309 were diagnosed in residents of CT 8056. Approximately half the cases in both the city and CT 8056 were males. The distribution of ages at time of diagnosis was similar for the city and CT 8056.

Tables 3 through 5 present cancer incidence by cancer type for all races combined, Whites, and Blacks. The most frequently diagnosed cancer types for both Long Branch and CT 8056 include colorectal, lung, breast, and prostate, representing between 50-56% of all incident cancers. The frequency of these cancer types is consistent with New Jersey statewide cancer incidence data.

Tables 6 through 8 present standardized incidence ratio (SIR) results for Long Branch by race (all races combined, White and Black) and sex. For all races combined (Table 6), brain and CNS cancer was statistically significantly elevated in females (SIR=1.62; 95% CI=1.12, 2.28) while stomach cancer in females was statistically significantly low (SIR=0.64; 95% CI=0.39, 0.98). For Whites (Table 7), statistically significantly elevated SIRs were seen for brain and CNS cancer in females (SIR=1.55; 95% CI=1.01, 2.27) and lung cancer in females (SIR=1.21; 95% CI=1.04, 1.40) while stomach cancer in females was statistically significantly low (SIR=0.55; 95% CI=0.30, 0.93). For Blacks (Table 8), brain and CNS cancer was statistically significantly elevated in females (SIR=3.17; 95% CI=1.27, 6.54) while a statistically significantly low SIR was found pancreatic cancer in males (SIR=0.18; 95% CI=0.00, 0.98).

Tables 9 through 11 present standardized incidence ratio (SIR) results for CT 8056 by race (all races combined, White and Black) and sex. For all races combined (Table 9), all cancers combined (SIR=1.34; 95% CI=1.14, 1.57) and lung cancer (SIR=1.59; 95% CI=1.08, 2.26) were statistically significantly elevated in males while esophageal cancer was statistically significantly elevated in females (SIR=5.74; 95% CI=1.85, 13.4). No SIRs for Whites in CT 8056 were statistically significantly high or low (Table 10). For Blacks in CT 8056 (Table 11), statistically significantly elevated SIRs were found for all cancers combined in males (SIR=1.35; 95% CI=1.11, 1.63) and for esophageal cancer in females (SIR=4.64; 95% CI=1.50, 10.8). While not statistically significantly high, SIRs were

elevated in Black females for brain and CNS cancer (SIR=4.3).

Discussion

The purpose of this investigation was to evaluate cancer incidence in a population living relatively near to areas contaminated by the Long Branch MGP. For the entire city of Long Branch, the occurrence of cancer (all sites combined) over the 22-year observation period was not higher than expected (based on average State rates) for any race-sex group evaluated. However, brain/CNS cancers in females citywide were statistically significantly elevated for all races combined (SIR=1.6), Whites (SIR=1.6), and Blacks (SIR=3.2). In contrast, stomach cancer tended to be lower than expected in most race-sex groups, and statistically significantly lower in some of the race-sex groups. Of the 81 SIRs calculated for Long Branch, four (5%) were statistically significantly high and four (5%) were statistically significantly low. Three SIRs (4%) were zero due to no observed cases.

For CT 8056, the census tract in which the Long Branch MGP facility was located, all cancers combined were statistically significantly higher in males when all races were combined (SIR=1.3) and in Black males (SIR=1.4). In addition, lung cancer was statistically significantly elevated in all males (SIR=1.6) while esophageal cancer was statistically significantly elevated for all females (SIR=5.7) and Black females (SIR=4.6). Brain/CNS cancers, while not statistically significant, were elevated for Black females (SIR=4.3). Of the 81 SIRs calculated for CT 8056, five (6%) were statistically significantly high and none were statistically significantly low. Nineteen SIRs (24%) were zero due to no observed cases.

Cancer is a group of more than 100 different diseases (i.e., cancer types and subtypes), each with their own set of risk factors. The multifactorial nature of cancer etiology, where a given disease may have more than one cause, complicates the evaluation of potential risk factors and specific disease outcomes. Benzene and PAHs, the primary contaminants at MGP site, have been identified as possible risk factors to exposed populations for certain cancer types, primarily leukemia (benzene) and lung cancer (PAHs). In the current analysis, the incidence of leukemia citywide and in CT 8056 was not statistically significantly higher than expected over the study time period. Lung

cancer incidence, however, was statistically significantly higher in White females citywide and all males in CT 8056.

While there are multiple risk factors for lung cancer, tobacco smoking is considered the most important risk factor, estimated to account for more than 85% of all lung cancer cases (National Cancer Institute, 1996). Other known risk factors for lung cancer include indoor exposure to radon and environmental tobacco smoke, occupational exposure to asbestos and other cancer-causing agents in the workplace (including radioactive ores; chemicals such as arsenic, vinyl chloride, nickel, chromates, coal products, mustard gas, and chloromethyl ethers; fuels such as gasoline; and diesel exhaust), and exposure to air pollution (American Cancer Society, 2003b).

There is very limited evidence that exposure to environmental contamination is associated with esophageal or stomach cancer risk. Occupational exposure to tetrachloroethylene, the solvent used in dry cleaning, may lead to greater risk of esophageal cancer (American Cancer Society, 2003c). Dry cleaning workers have a higher rate of esophageal cancer. Also, exposure to other chemical fumes may lead to an increased risk of esophageal cancer. However, the most important known risk factors for esophageal cancer are consumption of alcohol and tobacco products, which account for over 80% of the risk of squamous cell carcinoma of the esophagus (American Cancer Society, 2003c). A number of studies have shown an association between esophageal cancer and low socioeconomic status, independent of smoking or drinking, which may be associated with poor nutrition.

The causes of brain/CNS cancer are largely unknown, but a variety of genetic and environmental factors have been suggested (National Cancer Institute, 1996). The only established environmental risk factor for brain/CNS cancer is high dose ionizing radiation (American Cancer Society, 2003d). Certain occupations and industrial exposures have also been implicated as possible risk factors for brain/CNS cancer including chemists, embalmers, anatomists, precision metal workers, farmers, synthetic rubber and polyvinyl chloride manufacture, refining of crude oil and production of petroleum based chemicals, manufacture of pharmaceuticals, and the nuclear fuels and weapons industry (National

Cancer Institute, 1996). Additionally, while there is no conclusive evidence, exposure to electromagnetic fields has also been suggested as a possible risk factor for brain/CNS cancer.

A limitation of cancer studies of this type is the inability to assess past exposure levels in the population. The critical piece of information required to assure a meaningful evaluation of these data is actual personal exposure to the contamination as well as other relevant risk factors over time; that is, who was exposed and who was not exposed and the magnitude of the exposure that did occur. Since personal exposure information does not exist, residential distance from the contaminated site was used as a surrogate measure for potential past exposure. This was accomplished by analyzing separately the population living in the census tract in which the Long Branch MGP was located. Although distance from the site may have been the best way to estimate past potential exposures at the time the study was designed, it is also unlikely that all of the residents in these areas were exposed to the contamination. Additionally, the length of residence of each case is unknown, thereby potentially adding to exposure misclassification. The consequence of exposure misclassification would be to bias the results toward not finding an association (i.e., no exposure-health outcome relationship).

Another interpretation problem is that cancer is a chronic disease that takes many years after exposure to manifest as clinical disease. The information supplied by the State Cancer Registry provides only an address at time of diagnosis for each case. No information is available on length of time an individual may have lived at the address before diagnosis. It is possible that some cases are new, short-term residents with little or no exposure to the site. Furthermore, former residents who have moved out of the study area just prior to diagnosis are not available for analysis. Population mobility cannot be accounted for in this study. The current study assumes that in and out migration of cases will offset each other.

Additionally, when researchers independently examine statistical associations for a large number of comparisons, it is likely that some number of statistically elevated or low SIRs will occur by chance alone. While it is possible to statistically correct for this concern,

it is controversial whether such corrections are needed. Confidence intervals are presented without adjustment for multiple comparison.

The approach utilized for this descriptive cancer investigation was “census” based, where the entire population of Long Branch and the State of New Jersey were reviewed in order to calculate age, sex, and race standardized incidence rate ratios for the study area. This “census” approach (ecologic design) is a practical surveillance or screening method for cancer incidence. Although this approach is well suited for providing a picture of cancer incidence in the specific localities, cause-effect relationships cannot be evaluated. Important information on potential risk factors (such as genetics, environmental factors, parental occupation, etc.) that might explain the results, were not available for analysis using this type of study design.

Conclusions and Recommendations

Overall, cancer incidence (all cancers combined) was not elevated in Long Branch. However, brain/CNS cancer was elevated in all females citywide. Lung cancer in White females was higher than expected while stomach cancer was generally lower than expected. In CT 8056, the area of Long Branch which had the highest potential for exposure to benzene and PAHs from the site, excess levels of esophageal cancer in females, lung cancer in males, and all cancers combined in males was found. Leukemia incidence citywide and in CT 8056 was not higher than expected. While lung cancer incidence was higher in males living in CT 8056, lung cancer incidence was not higher than expected for females in CT 8056.

This analysis of cancer incidence in the City of Long Branch and CT 8056 provides little evidence that the rate of cancer in the study population has been affected by the potential exposure to MGP contamination. While no further cancer analyses appear to be warranted, the NJDHSS and ATSDR should continue to work with community representatives to determine the most appropriate health education and outreach strategies to inform the general population about environmental issues in the community.

Additionally, the results of this Health Consultation will be considered along with an evaluation of the exposure pathways, community health concerns, and other pertinent information in a future public health assessment of the site.

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Figure and Tables

Figure 1.

City of Long Branch
1990 Census Tract Boundaries
Manufactured Gas Plant
(Located in CT 8056)

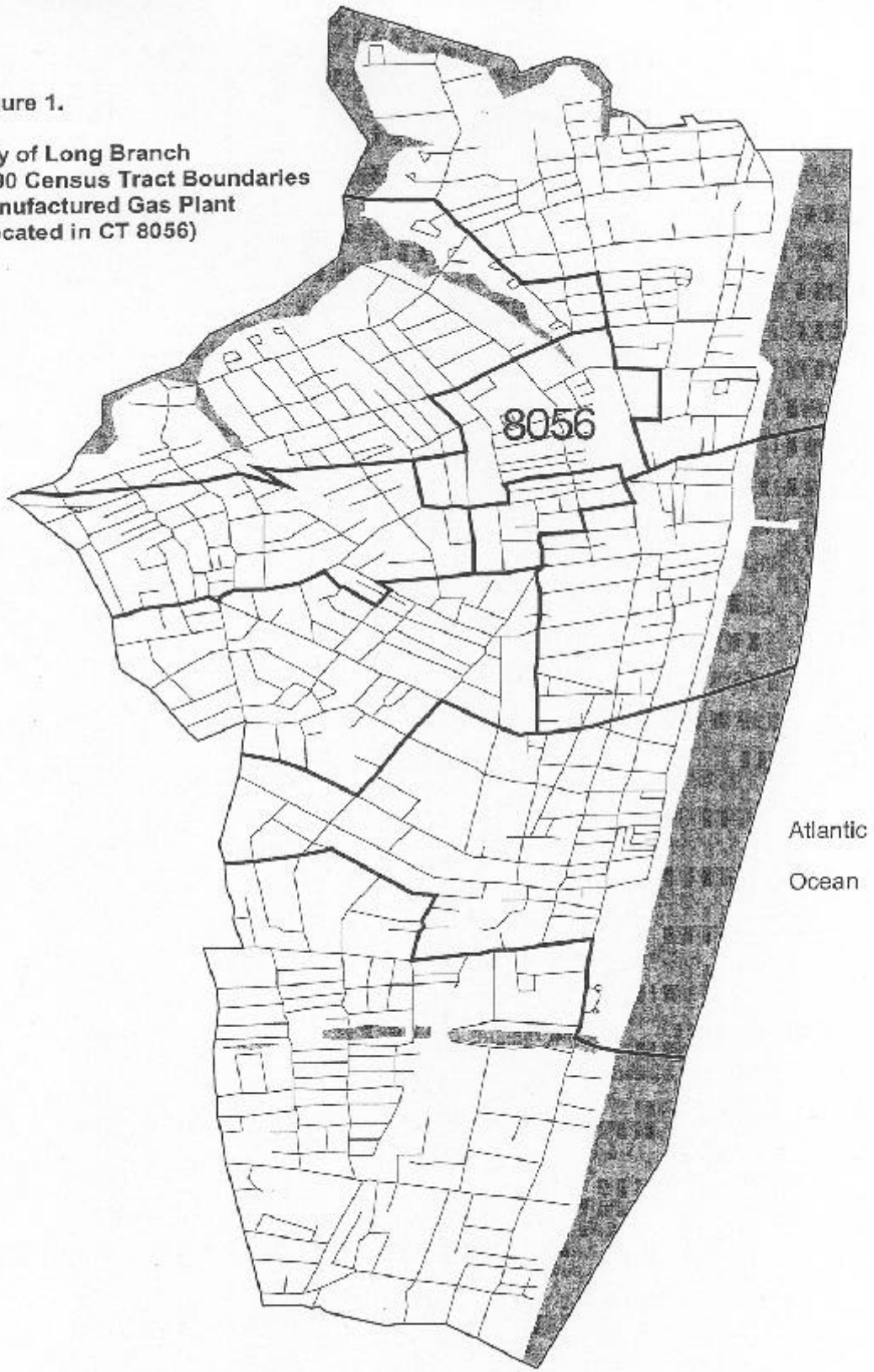

Table 1. Long Branch and Census Tract (CT) 8056
Population Numbers by Select Demographic Characteristics
Census Years 1980, 1990, and 2000

	City of Long Branch			CT 8056		
Characteristic	**1980**	**1990**	**2000**	**1980**	**1990**	**2000**
Race:						
White	22,204	21,064	21,320	734	627	669
Black	6,014	5,589	5,847	1,821	1,686	1,271
Other	1,601	2,005	4,173	192	308	358
Total	29,819	28,658	31,340	2,747	2,621	2,298
Sex:						
Male	13,795	13,464	15,210	1,147	1,180	1,070
Female	16,024	15,194	16,130	1,600	1,441	1,228
Age Distribution:						

Data from the New Jersey Department of Health and Senior Services' State Cancer Registry with analysis by the Department's Consumer and Environmental Health Services (August 2003).

0-4	2,128	2,051	2,183	235	236	226
5-9	1,920	1,777	2,155	259	257	220
10-14	2,178	1,653	2,013	278	214	219
15-19	2,304	1,643	1,880	296	230	161
20-24	2,976	2,170	2,419	230	189	148
25-29	2,670	2,871	2,489	168	212	155
30-34	2,631	2,831	2,682	149	189	150
35-39	1,542	2,307	2,592	131	162	155
40-44	1,201	1,791	2,384	111	138	134
45-49	1,563	1,411	2,143	123	118	120
50-54	1,329	1,188	1,803	129	121	119
55-59	1,471	1,194	1,469	116	102	92
60-64	1,698	1,366	1,092	130	116	101
65-69	1,311	1,292	1,034	120	109	89
70-74	1,200	1,183	1,042	90	82	79
75-79	784	905	831	73	58	59
80-84	504	572	634	62	49	39
85+	409	453	495	47	39	32

Table 2. Long Branch and Census Tract (CT) 8056
Number of Cancer Cases by Select Demographic Characteristics
Malignant Cancer Incidence[1] (1979-2000)

Demographic Characteristic	Long Branch	CT 8056
Race:		
White	2,734	109
Black	481	198
Other/Unknown	46	2
Total	3,261	309
Sex:		
Male	1,618	154
Female	1,643	155
Age at Diagnosis:		
0-4	16	<5
5-9	7	<5
10-14	6	<5
15-19	10	<5
20-24	15	<5
25-29	32	<5
30-34	44	<5
35-39	64	6
40-44	96	10
45-49	110	13
50-54	205	23
55-59	256	27
60-64	393	46
65-69	489	38
70-74	525	50
75-79	463	32
80-84	318	30
85+	212	17

[1] Note: Number of cases between 0 and 5 are suppressed for confidentiality.

Table 3. Long Branch and Census Tract (CT) 8056
Number of Cases[1] by Cancer Type (1979-2000): All Races Combined

Cancer Type	Long Branch	CT 8056
Oralpharynx	110	19
Esophagus	41	7
Stomach	51	<5
Small Intestine	17	<5
Colorectal	453	35
Liver	24	<5
Pancreas	85	6
Other Digestive	54	8
Lung	491	50
Other Respiratory	65	12
Bones and Joints	8	<5
Soft Tissue	23	<5
Melanoma	87	<5
Other Skin	14	<5
Breast	477	35
Cervix	50	10
Uterus	98	11
Ovary	56	<5
Other Female Genital	10	<5
Prostate	366	34
Other Male Genital	15	<5
Bladder	154	12
Kidney	72	7
Other Urinary	9	0
Eye	<5	0
Brain and Central Nervous System	54	<5
Thyroid	16	0
Other Endocrine	10	<5
Hodgkin's Disease	35	<5
Non-Hodgkin's Lymphoma	126	12
Myeloma	32	<5
Leukemia	76	9
Miscellaneous	78	8
Total	3,261	309

Data from the New Jersey Department of Health and Senior Services' State Cancer Registry with analysis by the Department's Consumer and Environmental Health Services (September 2003).

[1] Note: Number of cases between 0 and 5 are suppressed for confidentiality.

Data from the New Jersey Department of Health and Senior Services' State Cancer Registry with analysis by the Department's Consumer and Environmental Health Services (September 2003).

Table 4. Long Branch and Census Tract (CT) 8056
Number of Cases[1] by Cancer Type (1979-2000): White

Cancer Type	Long Branch	CT 8056
Oralpharynx	86	5
Esophagus	27	0
Stomach	39	<5
Small Intestine	14	0
Colorectal	389	11
Liver	17	0
Pancreas	78	<5
Other Digestive	43	0
Lung	419	17
Other Respiratory	47	<5
Bones and Joints	7	<5
Soft Tissue	17	0
Melanoma	85	<5
Other Skin	7	<5
Breast	413	19
Cervix	37	<5
Uterus	85	<5
Ovary	49	<5
Other Female Genital	7	0
Prostate	299	13
Other Male Genital	14	<5
Bladder	137	7
Kidney	60	<5
Other Urinary	9	0
Eye	<5	0
Brain and Central Nervous System	44	0
Thyroid	16	0
Other Endocrine	<5	0
Hodgkin's Disease	29	0
Non-Hodgkin's Lymphoma	103	<5
Myeloma	22	<5
Leukemia	68	<5
Miscellaneous	60	<5
Total	2,734	109

[1] Note: Number of cases between 0 and 5 are suppressed for confidentiality.

Data from the New Jersey Department of Health and Senior Services' State Cancer Registry with analysis by the Department's Consumer and Environmental Health Services (September 2003).

Data from the New Jersey Department of Health and Senior Services' State Cancer Registry with analysis by the Department's Consumer and Environmental Health Services (September 2003).

Table 5. Long Branch and Census Tract (CT) 8056
Number of Cases[1] by Cancer Type (1979-2000): Black

Cancer Type	Long Branch	CT 8056
Oralpharynx	23	14
Esophagus	14	7
Stomach	12	<5
Small Intestine	<5	<5
Colorectal	61	23
Liver	<5	<5
Pancreas	7	<5
Other Digestive	10	6
Lung	70	33
Other Respiratory	17	9
Bones and Joints	0	0
Soft Tissue	6	<5
Melanoma	0	0
Other Skin	5	<5
Breast	59	16
Cervix	12	7
Uterus	10	7
Ovary	6	<5
Other Female Genital	<5	<5
Prostate	57	21
Other Male Genital	<5	0
Bladder	14	5
Kidney	11	<5
Other Urinary	0	0
Eye	<5	0
Brain and Central Nervous System	10	<5
Thyroid	0	0
Other Endocrine	6	<5
Hodgkin's Disease	5	<5
Non-Hodgkin's Lymphoma	20	9
Myeloma	10	<5
Leukemia	8	5
Miscellaneous	16	6
Total	481	198

[1] Note: Number of cases between 0 and 5 are suppressed for confidentiality.

Data from the New Jersey Department of Health and Senior Services' State Cancer Registry with analysis by the Department's Consumer and Environmental Health Services (September 2003).

Table 6. Long Branch Malignant Cancer Incidence (1979-2000)
SIR Analysis by Cancer Type and Sex: All Races Combined

Cancer Type	Sex	Observed	Expected	SIR[1]		95% CI
All Cancers Combined	Male	1,618	1,614.8	1.00		0.95 - 1.05
	Female	1,643	1,642.1	1.00		0.95 - 1.05
Bladder	Male	111	123.7	0.90		0.74 - 1.08
	Female	43	48.1	0.89		0.65 - 1.20
Bone/Joint	Male	<5	NR	0.87		0.17 - 2.54
	Female	5	3.0	1.65		0.53 - 3.85
Brain/CNS	Male	21	22.9	0.92		0.57 - 1.40
	Female	33	20.4	1.62	*	1.12 - 2.28
Breast	Male	<5	NR	1.02		0.27 - 2.62
	Female	473	478.0	0.99		0.90 - 1.08
Colorectal	Male	231	234.3	0.99		0.86 - 1.12
	Female	222	246.2	0.90		0.79 - 1.03
Esophagus	Male	29	24.4	1.19		0.80 - 1.71
	Female	12	10.0	1.20		0.62 - 2.10
Kidney	Male	47	42.5	1.11		0.81 - 1.47
	Female	25	29.0	0.86		0.56 - 1.27
Leukemia	Male	44	41.8	1.05		0.76 - 1.41
	Female	32	35.0	0.92		0.63 - 1.29
Liver	Male	16	12.5	1.28		0.73 - 2.08
	Female	8	6.5	1.23		0.53 - 2.43
Lung	Male	284	275.6	1.03		0.91 - 1.16
	Female	207	182.4	1.13		0.99 - 1.30
Non-Hodgkin's Lymphoma	Male	68	58.2	1.17		0.91 - 1.48
	Female	58	57.1	1.02		0.77 - 1.31
Pancreas	Male	39	35.4	1.10		0.78 - 1.50
	Female	46	41.3	1.11		0.82 - 1.49
Stomach	Male	31	43.9	0.71		0.48 - 1.00
	Female	20	31.4	0.64	**	0.39 - 0.98

Data from the New Jersey Department of Health and Senior Services' State Cancer Registry with analysis by the Department's Consumer and Environmental Health Services (September 2003).

[1] Note: *=statistically high, **= statistically low, NR= not reported because observed <5.

Table 7. Long Branch Malignant Cancer Incidence (1979-2000)
SIR Analysis by Cancer Type and Sex: White

Cancer Type	Sex	Observed	Expected	SIR[1]	95% CI

Data from the New Jersey Department of Health and Senior Services' State Cancer Registry with analysis by the Department's Consumer and Environmental Health Services (September 2003).

All Cancers Combined	Male	1,334	1,342.7	0.99		0.94 - 1.05
	Female	1,400	1,369.8	1.02		0.97 - 1.08
Bladder	Male	98	111.6	0.88		0.71 - 1.07
	Female	39	42.5	0.92		0.65 - 1.26
Bone/Joint	Male	<5	NR	1.13		0.23 - 3.30
	Female	<5	NR	1.70		0.46 - 4.36
Brain/CNS	Male	18	18.9	0.95		0.56 - 1.50
	Female	26	16.8	1.55	*	1.01 - 2.27
Breast	Male	<5	NR	0.91		0.18 - 2.67
	Female	410	397.7	1.03		0.93 - 1.14
Colorectal	Male	198	202.1	0.98		0.85 - 1.13
	Female	191	212.0	0.90		0.78 - 1.04
Esophagus	Male	20	17.5	1.14		0.70 - 1.76
	Female	7	7.4	0.94		0.38 - 1.94
Kidney	Male	40	35.7	1.12		0.80 - 1.53
	Female	20	24.5	0.82		0.50 - 1.26
Leukemia	Male	38	34.8	1.09		0.77 - 1.50
	Female	30	29.1	1.03		0.70 - 1.47
Liver	Male	11	9.4	1.17		0.58 - 2.09
	Female	6	5.2	1.16		0.43 - 2.53
Lung	Male	233	227.1	1.03		0.90 - 1.17
	Female	186	153.7	1.21	*	1.04 - 1.40
Non-Hodgkin's Lymphoma	Male	56	48.6	1.15		0.87 - 1.50
	Female	47	48.7	0.97		0.71 - 1.28
Pancreas	Male	38	29.5	1.29		0.91 - 1.77
	Female	40	34.5	1.16		0.83 - 1.58
Stomach	Male	25	35.6	0.70		0.45 - 1.04
	Female	14	25.2	0.55	**	0.30 - 0.93

[1] Note: *=statistically high, **= statistically low, NR= not reported because observed <5.

Data from the New Jersey Department of Health and Senior Services' State Cancer Registry with analysis by the Department's Consumer and Environmental Health Services (September 2003).

Table 8. Long Branch Malignant Cancer Incidence (1979-2000)
SIR Analysis by Cancer Type and Sex: Black

Cancer Type	Sex	Observed	Expected	SIR[1]		95% CI
All Cancers Combined	Male	259	234.3	1.11		0.97 - 1.25
	Female	222	213.7	1.04		0.91 - 1.18
Bladder	Male	11	6.4	1.73		0.86 - 3.10
	Female	<5	NR	0.74		0.15 - 2.16
Bone/Joint	Male	0	0.5	0		-
	Female	0	0.4	0		-
Brain/CNS	Male	<5	NR	1.34		0.27 - 3.91
	Female	7	2.2	3.17	*	1.27 - 6.54
Breast	Male	<5	NR	1.83		0.02 - 10.2
	Female	58	59.2	0.98		0.74 - 1.27
Colorectal	Male	31	25.5	1.22		0.83 - 1.73
	Female	30	29.5	1.02		0.69 - 1.45
Esophagus	Male	9	8.2	1.10		0.50 - 2.09
	Female	5	3.0	1.65		0.53 - 3.85
Kidney	Male	7	5.4	1.30		0.52 - 2.69
	Female	<5	NR	1.05		0.28 - 2.70
Leukemia	Male	6	4.4	1.36		0.50 - 2.95
	Female	<5	NR	0.48		0.05 - 1.74
Liver	Male	<5	NR	1.72		0.46 - 4.41
	Female	0	1.1	0		-
Lung	Male	50	47.9	1.04		0.77 - 1.38
	Female	20	25.5	0.78		0.48 - 1.21
Non-Hodgkin's Lymphoma	Male	10	6.4	1.57		0.75 - 2.88
	Female	10	5.8	1.73		0.83 - 3.18
Pancreas	Male	<5	NR	0.18	**	0.00 - 0.98
	Female	6	6.6	0.91		0.33 - 1.99
Stomach	Male	6	7.6	0.79	**	0.29 - 1.73
	Female	6	5.7	1.05		0.39 - 2.30

Data from the New Jersey Department of Health and Senior Services' State Cancer Registry with analysis by the Department's Consumer and Environmental Health Services (September 2003).

[1] Note: *=statistically high, **= statistically low, NR= not reported because observed <5.

Table 9. Long Branch Census Tract 8056
Malignant Cancer Incidence (1979-2000)
SIR Analysis by Cancer Type and Sex: All Races Combined

Cancer Type	Sex	Observed	Expected	SIR[1]	95% CI

Data from the New Jersey Department of Health and Senior Services' State Cancer Registry with analysis by the Department's Consumer and Environmental Health Services (September 2003).

All Cancers Combined	Male	154	114.6	1.34	*	1.14 - 1.57
	Female	155	142.8	1.09		0.92 - 1.27
Bladder	Male	9	8.8	1.03		0.47 - 1.95
	Female	<5	NR	0.71		0.14 - 2.08
Bone/Joint	Male	<5	NR	3.6		0.05 - 19.9
	Female	0	0.0	0		-
Brain/CNS	Male	0	1.7	0		-
	Female	<5	NR	1.65		0.33 - 4.83
Breast	Female	35	41.4	0.85		0.59 - 1.18
Colorectal	Male	16	16.6	0.96		0.55 - 1.56
	Female	19	21.6	0.88		0.53 - 1.38
Esophagus	Male	<5	NR	1.15		0.13 - 4.16
	Female	5	0.9	5.74	*	1.85 - 13.4
Kidney	Male	6	3.0	1.99		0.73 - 4.33
	Female	<5	NR	0.39		0.01 - 2.19
Leukemia	Male	5	3.1	1.59		0.51 - 3.72
	Female	<5	NR	1.28		0.34 - 3.27
Liver	Male	<5	NR	2.26		0.25 - 8.15
	Female	0	0.6	0		-
Lung	Male	31	19.5	1.59	*	1.08 - 2.26
	Female	19	15.9	1.19		0.72 - 1.87
Non-Hodgkin's Lymphoma	Male	6	4.1	1.46		0.53 - 3.18
	Female	6	5.0	1.21		0.44 - 2.63
Pancreas	Male	0	2.5	0		-
	Female	6	3.6	1.67		0.61 - 3.62
Stomach	Male	<5	NR	0.32		0.00 - 1.79
	Female	<5	NR	0.73		0.08 - 2.63

[1] Note: *=statistically high, **= statistically low, NR= not reported because observed <5.

Table 10. Long Branch Census Tract 8056
Malignant Cancer Incidence (1979-2000)
SIR Analysis by Cancer Type and Sex: White

Data from the New Jersey Department of Health and Senior Services' State Cancer Registry with analysis by the Department's Consumer and Environmental Health Services (September 2003).

Cancer Type	Sex	Observed	Expected	SIR[1]	95% CI
All Cancers Combined	Male	48	38.6	1.24	0.92 - 1.65
	Female	61	54.5	1.12	0.86 - 1.44
Bladder	Male	5	3.3	1.54	0.50 - 3.59
	Female	<5	NR	1.09	0.12 - 3.95
Bone/Joint	Male	<5	NR	12.8	0.17 - 71.0
	Female	0	0.1	0	-
Brain/CNS	Male	0	0.5	0	-
	Female	0	0.6	0	-
Breast	Female	19	15.1	1.26	0.76 - 1.97
Colorectal	Male	<5	NR	0.51	0.10 - 1.49
	Female	8	9.4	0.85	0.37 - 1.68
Esophagus	Male	0	0.5	0	-
	Female	0	0.3	0	-
Kidney	Male	<5	NR	2.98	0.60 - 8.72
	Female	<5	NR	1.01	0.01 - 5.63
Leukemia	Male	<5	NR	0.98	0.01 - 5.45
	Female	<5	NR	2.47	0.50 - 7.21
Liver	Male	0	0.3	-	-
	Female	0	0.2	-	-
Lung	Male	8	6.5	1.24	0.53 - 2.44
	Female	9	6.1	1.48	0.68 - 2.82
Non-Hodgkin's Lymphoma	Male	<5	NR	0.73	0.01 - 4.05
	Female	<5	NR	0.50	0.01 - 2.80
Pancreas	Male	0	0.9	0	-
	Female	<5	NR	1.33	0.15 - 4.79
Stomach	Male	<5	NR	0.97	0.01 - 5.38
	Female	0	1.2	0	-

[1] Note: *=statistically high, **= statistically low, NR= not reported because observed <5.

Data from the New Jersey Department of Health and Senior Services' State Cancer Registry with analysis by the Department's Consumer and Environmental Health Services (September 2003).

Table 11. Long Branch Census Tract 8056
Malignant Cancer Incidence (1979-2000)
SIR Analysis by Cancer Type and Sex: Black

Cancer Type	Sex	Observed	Expected	SIR[1]	95% CI

Data from the New Jersey Department of Health and Senior Services' State Cancer Registry with analysis by the Department's Consumer and Environmental Health Services (September 2003).

All Cancers Combined	Male	106	78.5	1.35	*	1.11 - 1.63
	Female	92	74.7	1.23		0.99 - 1.51
Bladder	Male	<5	NR	2.24		0.48 - 4.57
	Female	<5	NR	1.55		0.01 - 3.59
Bone/Joint	Male	0	0.1	0		-
	Female	0	0.1	0		-
Brain/CNS	Male	0	0.7	0		-
	Female	<5	NR	4.26		0.86 - 12.5
Breast	Female	16	19.8	0.81		0.46 - 1.31
Colorectal	Male	13	8.7	1.49		0.79 - 2.55
	Female	10	11.1	0.90		0.43 - 1.66
Esophagus	Male	<5	NR	0.82		0.09 - 2.96
	Female	5	1.1	4.64	*	1.50 - 10.8
Kidney	Male	<5	NR	1.77		0.35 - 5.16
	Female	0	1.3	0		-
Leukemia	Male	<5	NR	2.84		0.76 - 7.27
	Female	<5	NR	0.69		0.01 - 3.86
Liver	Male	<5	NR	2.74		0.31 - 9.89
	Female	0	0.4	0		-
Lung	Male	23	15.9	1.45		0.92 - 2.17
	Female	10	9.2	1.10		0.52 - 2.02
Non-Hodgkin's Lymphoma	Male	5	1.9	2.70		0.87 - 6.31
	Female	<5	NR	2.03		0.54 - 5.19
Pancreas	Male	0	1.9	0		-
	Female	<5	NR	1.61		0.43 - 4.13
Stomach	Male	0	2.6	0		-
	Female	<5	NR	0.92		0.10 - 3.31

[1] Note: *=statistically high, **= statistically low, NR= not reported because observed <5.

Data from the New Jersey Department of Health and Senior Services' State Cancer Registry with analysis by the Department's Consumer and Environmental Health Services (September 2003).